

INSTITUTE FOR ADVANCED STUDY IN TOULOUSE

EXPLORING DARWIN'S LEGACY

STRANGER THINGS COVID-19 RESEARCH UPDATES CHIEFS, SHAMANS AND FOLLOWERS CAN PERSONALITY BE PREDICTED AT BIRTH?





Biannual magazine of the Institute for Advanced **Study in Toulouse**

Commissioning editor Paul Seabright

Editor-in-chief Jennifer Stephenson

Production manager Jean-Baptiste Grossetti

Reporting and editorial contributions James Nash

Iconography @Unslpash @AdobeStock @freenik @ShutterStock @StudioTchiz @JC Caslot

ISSN number: 2554-2141

Graphic design, layout Agence Blackpaper blackpaper.fr

1,000 magazines printed on 100% recycled paper Iso14001 - Imprim'Vert



KEEP IN TOUCH

Contact us

IAST 1, Esplanade de l'Université 31080 Toulouse Cedex 06, France +33 (0)5 67 73 29 76







This magazine has been funded by a French government subsidy managed by the Agence Nationale de la Recherche under the framework of the investissements d'avenir programme reference ANR-17-EURE-0010.



OUR SCIENTIFIC VISION

The Institute for Advanced Study in Toulouse is a unified scientific project that aims to study human behavior.

Our ambition is to break down artificial disciplinary boundaries to unlock new ideas and address the challenges of the 21st century. We have a team of resident full-time researchers in Toulouse, meeting several times a week across all social-science disciplines.

IAST researchers also work in partnership with economists and mathematicians at Toulouse School of Economics, Toulouse 1 Capitole University, INRA and CNRS. Our methods focus on analytical and quantitative methods, including case-study evidence. We believe our work needs to spread across the oceans and therefore. year after year, we welcome some of the world's best researchers, including a network of visitors from 27 countries.

IAST MAG #17 CONTENTS

IAST in the news Events & press	4
Covid-19 projects The IAST community takes on the	6
New research units	8

OUR **EVOLUTIONARY LEGACY**

Darwin and the social contrac IAST researchers	t 12
Stranger things Gladys Barragan-Jason, Alexis Chaine, Astrid Hopfensitz and Maxime Cauchoix	14
Prehistoric puzzles Andaine Seguin-Orlando	16
<mark>Dads vs Cads</mark> Ingela Alger, Jonathan Stieglitz	18
Chiefs, shamans and followers Zachary Garfield	20
Sex hormones and preferences Boris van Leeuwen	22

A special thanks to Paul Seabright for directing the IAST since 2012.

Editorial

Darwin's vision can unlock the mysteries of human society

S ocieties are strange beasts that can behave and develop in ways that do not resemble the behavior and development of any of their members. All members of a society grow older, but the society itself can grow younger. Societies can collectively know things that none of their members know. They can collectively choose chaos, corruption, or the rapid propagation of a disease in a pandemic, even though none of their members have knowingly chosen any of these things.

Individual life histories may not mirror those of their societies. Migrants can improve their own incomes and those of others by moving from poor to rich countries, but in doing so they typically lower the average income of both countries. Even if all social groups in a society are becoming more prosperous, if population is increasing faster among poorer social groups, median income can decline. In these and many other ways, we misrepresent societies by anthropomorphizing them, but it is often hard to understand their functioning except in terms of metaphors drawn from the lives of recognizable representative individuals. Social science can sometimes appear condemned to use a statistical language that individual human beings are congenitally unfitted to understand.

Charles Darwin was one of the first thinkers to recognize that what is good for individuals may be bad for societies and vice versa (Adam Smith had reached similar insights in a very different way). Random modifications to an individual's physiology or behavior (he hardly ever called them "mutations", and never used the word in the sense known to geneticists) are very rarely good news to an individual, just as banging on your computer in frustration is very rarely a good way to improve its performance. And yet, astonishingly, mutations are the source of most of the improvements in the ability of populations to confront the multiple challenges of their existence, such as eating, growing, fighting and reproducing. The solution to the paradox lies in heredity plus selection: of the many random mutations that arise in nature, almost of all of which are neutral or harmful, the tiny minority that are beneficial have a disproportionately large probability of being retained, and of spreading in the population via heredity from one generation to the next. Darwin's insight was that no society is adequately represented by its typical individuals - variety is everywhere, variety is everything. Societies develop in ways that no individuals ever do.

This year marks the 150th anniversary of the publication of Darwin's The Descent of Man, the first of his books in which he applied the theory of evolution by natural selection to the human species, something he had carefully avoided doing in *The Origin of Species*. The book was full of paradoxes: among other radical suggestions, Darwin floated the idea that altruism and cooperativeness might have been favored by natural selection because of their role in helping groups to compete effectively with one another. While many of its details have been overtaken by subsequent research, the breadth of Darwin's vision remains astonishingly relevant even today. And it is an inspiring reminder that societies are a fitting challenge for study by the most ambitious researchers precisely because they resist assimilation to simple metaphors based on the familiar developments in a single individual's life.







PAUL **SFABRIGHT**

IAST Director

Professor. **Toulouse School** of Economics

 ∞



PRESS



IAST PUBLIC WEBINAR THE LIFELONG SCARS OF COVID-19

In a public webinar on November 17, Astrid Hopfensitz (TSE-IAST-UT1C) and Victor Gay (TSE-IAST-UT1C) shared insights on the lasting consequences of the pandemic. Astrid detailed the potential psychological impact while Victor drew comparisons with previous crises to suggest likely outcomes of the current situation.



FOLLOW THE SOCIAL SCIENCE

IAST Director Paul Seabright is a regular contributor to *Le Monde*, recently discussing scientific news such as how sperm whales use social learning to avoid fishermen, the impact of the pandemic on voters, and the virtues of nepotism in the British Royal Navy.



ANCIENT WOMEN WERE ALSO BIG-GAME HUNTERS

Former IAST Research Fellow Vivek Venkataraman wrote in The Conversation about recent archeological evidence from Peru challenging the common belief that prehistoric humans had strictly defined gender roles regarding hunting and gathering.

CAN LOVE BE NEGOTIATED? Astrid Hopfensitz was interviewed in a French video series called StupidEconomics on her work on household economics. She explained how couples take economic decisions.

THE BENEFITS OF LEGALIZING IMMIGRATION

Emmanuelle Auriol discussed immigration in a 40-minute Investiga'Sciences podcast dedicated to scientific outreach with Stéphanie Lima, a geographer at the University of Toulouse II - Jean Jaures and the LISST Laboratory.



Paul Seabright was interviewed by the BBC on the global supply chain and how Britain may find itself exposed. The IAST Director explained how the balance between imports and domestic production is a complex trade-off.



CLIMATE CHANGE AND CARING DADS IAST-TSE-CNRS professor Ingela Alger was interviewed by the Toulouse University magazine, Explorer, on paternal care in ancient times. Her recent work shows that climate change pushed fathers to spend more time with their children as food became harder to come by. See page 18-19 of this issue.

March 29

IAST PUBLIC WEBINAR

ECONOMICS OF ANIMAL WELFARE

On March 29, Nicolas Treich (TSE-IAST-INRAE) and Romain Espinosa (University Rennes 1 - CNRS) talked about the latest research on the economics of animal welfare. After a 20-minute presentation, the pair discussed the subject with the audience.





GLOBAL SUPPLY CHAINS: IS THE UK VULNERABLE?

ഹ

THE NEXT WAVE

The IAST community takes on the pandemic

The Covid-19 crisis is still raging with big differences between countries and long-term scars that are particularly complicated to assess. As they seek to advance amid the upheaval, IAST behavioral scientists are working on a wide range of multidisciplinary projects that aim to inform policymakers' response to the pandemic. In this section, we present updates from some of these efforts.



BENCE BAGO

EMOTIONS AND FAKE NEWS

The IAST cognitive psychologist has updated his work about how our emotions can impact the way we respond to news headlines. Following a large-scale experiment in Nigeria, the researcher found that experiencing any emotion after reading a headline associated with greater belief in false headlines, relative to true headlines. Respondents were better at discerning real news from fake news when they experienced no emotion after reading a headline. Bence and his co-authors also found that surprise and happiness were associated with greater belief in and sharing of false Covid-19 headlines.



SYLVIE BORAU & ASTRID HOPFENSITZ

MARRIED PEOPLE ARE MORE COOPERATIVE

Combining their expertise in psychology, marketing and economics, analysis by Astrid Hopfensitz (IAST-TSE), Sylvie Borau (TBS-IAST) and Hélène Couprie (LEST-CNRS-Aix-Marseille University) shows that married people are more likely to comply with protective health restrictions than single people. These findings help explain the greater vulnerability of single people – and particularly single men – to Covid-19, and could be leveraged to improve the effectiveness of international public policy campaigns. With data collected from 46,450 respondents in 67 countries, the authors found their results to be consistent across countries and genders.



Astrid Hopfensitz (IAST-TSE) and her former IAST colleague César Mantilla (Universidad del Rosario) have designed a study to analyze the ease with which we can detect smiles by someone who is wearing a mask. Respondents are asked to pick the smiling person out of two different pictures. The results could help assess the impact of wearing masks on social relations.



HORACIO LARREGUY

HEALTHIER INFORMATION SUR-ROUNDING COVID-19 IN THE WORLD

IAST Visiting Fellow Horacio Larreguy has been hard at work to find ways to improve the information environment surrounding Covid-19 in Bolivia, Egypt, Mexico, and Zimbabwe. In Bolivia and Zimbabwe, he has been helping policymakers and NGOs to find the best ways to tackle misinformation and vaccination hesitancy.

In Zimbabwe, he and his co-authors implemented a large-scale experiment on WhatsApp to show the positive impact of fact-checks on correct beliefs about fake news and associated preventative behavior.

In Bolivia, he evaluated a randomized intervention providing training to journalists on techniques to reduce misinformation in their publications, with moderate success on the contents published following the training. The study pointed to the incentive for journalists to publish "sexy" content, which tends to be opposite to the true information conveyed by fact-checks, as a significant constraint to the greater success of the intervention.

Among other projects, Horacio is currently studying the effect of disseminating information about incumbent performance regarding Covid-19 during the electoral campaign in Mexico.

Discussing his work with *IAST magazine*, he concluded: "The current crisis is extremely tricky in terms of the informational environment because there have been many uncertainties regarding the pandemic, its spread, the effects of policies to counter it, among many other things. Nonetheless, it is a fascinating environment to study the importance of information, and particularly misinformation, with real-life consequences."



CHARLES WYPLOSZ

COVID ECONOMICS: A NEW KIND OF PUBLICATION

At the end of February 2020, the Center for Economic and Policy Research (CEPR) published two online books inviting economists to give their opinion on the Covid-19 pandemic. Following the success of these ebooks and inspired by pre-print tradition in physics and medical science, CEPR president Beatrice Weder and VoxEU director Richard Baldwin decided to launch a freely accessible website to quickly bring together contributions from economists around the world. Professor Charles Wyplosz (Graduate Institute, Geneva) was tasked with organizing the publication with the support of the CEPR structure.

Covid Economics guaranteed a 48-hour response to submission of research papers. Speaking to an IAST seminar in January, Charles insisted this marks a revolution in the field of economics where the response delay is usually counted in years. As of June 9, he and his team have received 1,136 articles, publishing 496 of them over 80 editions.

Charles remembers the first flood of articles in the wake of the launch of the website: "In the first few days, economists took the epidemiologists' models and adapted them to the current pandemic. This interdisciplinary merging of models, as well as the data shared by the likes of Google and Apple, allowed economists to conduct empirical studies as well as update their models. From the start, the unequal impact of the pandemic has been striking: It's been clear that privileged people were less impacted. Another big surprise is the convergence of results from different fields over time."

The French economist insists on the uniqueness of the endeavor: "This type of journal has never existed in economics before, it is a first in the history of the discipline. We contacted the 25 best economics journals to explain what we were doing and asked them to accept that the pre-prints we published could be resubmitted in the future to these journals. We were positively surprised that each and every one of the journals accepted.

At the height of the pandemic, Charles and his team sometimes published three editions per week, but things are now starting to calm down as the article submissions slowed and *Covid Economics* is becoming a weekly publication.

Meet the IAST research teams

To foster collaboration across disciplines, IAST is launching three new research teams which will encourage scholars to exchange ideas, skills, and perspectives on key topics that reflect flourishing research areas in Toulouse. The first new units will focus on Evolution of Technology, Leadership, Power and Inequality, and Social Evolution. Research team leaders Maxime Derex, Roberta Dessí, and Jorge Peña tell us more about these innovative projects.

EVOLUTION OF TECHNOLOGY

Full members:

ω

- > Jean-François Bonnefon, CNRS (psychology)
- > Jane Conway, IAST (psychology)
- > Maxime Derex, CNRS (anthropology, psychology)
- > Zach Garfield, IAST (anthropology)
- > Victor Gay, TSE (economics)
- > Astrid Hopfensitz, IAST/TSE (economics)
- > Antoine Jacquet, TSE (economics)
- > Sabine Nöbel, IAST (biology)
- > Zoe Purcell, IAST (psychology)
- > Jonathan Stieglitz, IAST/UT1 (anthropology)
- > Manvir Singh, IAST (anthropology)

Associate members:

> Paul Seabright, IAST/TSE (economics)

LEADERSHIP, POWER AND INEQUALITY

Full members:

- > Lauren Bader, IAST (psychology)
- > Roberta Dessí, IAST/TSE (economics)
- > Zachary Garfield, IAST (anthropology)
- > Yuzuru Kumon, IAST (economic history)
- > Catherine Molho, IAST (psychology)
- > Erik Wang, IAST (political science)

Associate members:

- > Christopher von Rueden, University of Richmond (anthropology)
- > Paul Seabright, IAST/TSE (economics)
- > Manvir Singh, IAST (anthropology)

SOCIAL EVOLUTION

Full members:

- > Péter Bayer, TSE (economics)
- > Maxime Derex, CNRS (anthropology, psychology)
- > Gonçalo Faria, IAST (biology)
- > **Zach Garfield,** IAST (anthropology)
- > Catherine Molho, IAST (psychology)
- > Sabine Nöbel, IAST (biology)
- > Jorge Peña, IAST/UT1 (biology)
- > Francesca De Petrillo, TSE-IAST (economics)
- > Manvir Singh, IAST (anthropology)

Associate member:

> Ingela Alger, TSE-IAST (economics)



INTERVIEW



WHAT ARE THE OBJECTIVES OF THESE NEW RESEARCH TEAMS?

Maxime Derex: The team will encourage the implementation of research projects with concrete and short-term objectives as tools for promoting and accelerating mutual understanding between scholars from different disciplines. Concretive objectives will give team members the opportunity to engage in focused, in-depth discussions and will help both refine research protocols and reveal additional collaboration opportunities.

Roberta Dessí: Much of the existing research that studies leadership, or inequality, does so from the perspective of a single discipline. Working together across the disciplines in the team will harness different knowledge and methodologies, challenge some existing perspectives and develop new ones.

Jorge Peña: We thought that concentrating a team of researchers on a given topic would foster more connections between the disciplines, which is the core ambition of IAST and a difficult task to pull off. Even though the IAST has had great success in the past 10 years at collaborating across disciplines, we believe that this new cooperation model can thrive and lead to better discoveries.

HOW WERE THESE TEAMS FORMED?

RD: When the call came, I had been thinking for some time about status, power and leadership, and I thought that these topics would be perfect for an interdisciplinary research team. I had a rough idea of what other people at IAST were working on, which suggested potential members. I contacted the people I had in mind and discussed the possible team with them. We began with a series of informal meetings during which research projects and ideas were presented. This was an opportunity for team members to get to know each other's research in this area better and to start interacting. We then worked together on the research team proposal.

JP: The IAST Management Committee launched a call for research teams at the end of 2020, and we were the three projects that made it through the selection process. Another round will take place in 2021.

WHICH TOPICS WILL THEY COVER?

ER

0

MD: Technology has affected all facets of human life over the course of our evolutionary history: our bodies, our brains, our social lives, and our environments. The team will seek to improve our understanding of the evolution of technology over short, long, and very longtime scales and its implications for human biological and cultural evolution. It will address questions such as: What determines rates of technological evolution? How does technology spread within and between social groups? To what extent does technology change the parameters of its own evolution by affecting the way we process, share, and store information? How does technology affect our use of time, space, and natural resources?

RD: We aim to study leadership through multiple research angles, focusing on the roles of leaders and how they evolved over time, how individuals become leaders, and how individual strategies and group dynamics shape patterns of leadership and followership. Our research will explore how power affects social behaviors such as cooperation and punishment; it will also study the underlying mechanisms driving the dynamics of inequality patterns.

JP: Our research team will look into the evolution of cooperation and social behaviors in humans and non-humans. A particular focus will be to rethink the foundations of the cultural evolution of human cooperation, and to study the bottom-up emergence and evolution of institutions regulating collective action. To do so, we will combine theoretical models with lab experiments and fieldwork.

HOW INNOVATIVE ARE THESE PROJECTS?

RD: I have some experience of collaborating with a researcher from another discipline on a specific paper, but a multidisciplinary research team like this is new to me. I haven't heard of anything similar elsewhere, this seems quite special.



The origins of human behavior

Fearing controversy, Charles Darwin initially avoided addressing human evolution. But when he came to write *The Descent of Man* he made it very clear that natural selection had shaped our behavior, as well as our bodies. The subsequent century and a half has demonstrated the power of his insight.

For much of the 20th century, explanations of human behavior in terms of environmental factors were considered substitutes, rather than complements, to explanations drawing on natural selection. It is now much easier to accept that we are hardwired by natural selection to be flexible learners who are massively influenced by signals from our natural and social environments.

In a tribute to *The Descent of Man* on the 150th anniversary of its publication, this issue of IAST magazine celebrates the evolutionary perspective that continues to galvanize so much of the cutting-edge research by Toulouse's scientific community. Ξ

That can evolutionary science Il us about human nature? arwin and the social contract	12
ow do children cooperate ith others? ranger things	14
ecoding DNA from Neolithic farmers rehistoric puzzles	16
id caring fathers evolve due climate change? ads vs Cads	18
ike me to your leader hiefs, shamans and followers	20
an personality be predicted at birth? ex hormones and preferences	22



IAST RESEARCHERS DARWIN AND THE SOCIAL CONTRACT

What can evolutionary science tell us about human nature?

When Hobbes wrote that life without government was 'solitary, poor, nasty, brutish and short', he made generalizations based on his own and others' observations. So did Rousseau, when he claimed that 'man is born free, and he is everywhere in chains'. How do their ideas about human nature stand up in the light of recent empirical research? IAST researchers Paul Seabright, Jonathan Stieglitz, and Karine Van der Straeten show how evolutionary social science, inspired by Darwin, can change the way we think about human behavior and society.

nvited to contribute to a special issue of Evolutionary Human Sciences, Paul Seabright, Jonathan Stieglitz and Karine Van der Straeten focus on three highly influential philosophers who developed the 'social contract' device to establish the principles of legitimate political power. Hobbes, Locke and Rousseau suggest that modern society's formal institutions (such as written laws, charters, and constitutions) derive their authority from a mutual accord between free-spirited humans in their 'natural' state.

 $\overline{\mathbf{N}}$

For Hobbes, the state of nature involved such fear and potential for violence that a repressive monarchy was much to be preferred; for Rousseau, civilization created far greater evils than had previously existed. Despite such differences, they both made the radically novel distinction between the state of nature and modern societies. In the minds of earlier thinkers such as Confucius, humans were unimaginable as abstracted from society. But for the social contract theorists, humans become social only by their own will.

A SOCIAL ANIMAL

Advances in behavioral science allow us to evaluate the idea that we are individualistic and rational by nature. Double-blinded lab experiments reveal how individuals behave when interacting with anonymous others. Instead of demonstrating pure selfinterest, individuals often make altruistic donations to others they will never meet; respond to the behavior of others with strong reciprocity; contribute to public goods; and punish injustice experienced by others, even at a cost to themselves.

"Hobbes, Locke and Rousseau suggest that modern society's formal institutions derive their authority from a mutual accord between free-spirited humans in their 'natural' state"

Small-scale societies - including foragers, horticulturalists, pastoralists and subsistence-level economies - may come closest to constituting a 'human nature' that can be compared with the social contract theorists' depiction. Far from being 'solitary', the latest cross-cultural research reveals these

societies to be characterized by threegenerational systems of resource flows. sexual and age-graded division of labor within long-term adult pair bonds, and high levels of cooperation between kin and non-kin.

In the archaeological record, 'base camps' - which reflect forager sociality - are evident at least 400,000 years ago. Genetic evidence of interbreeding reveals the formation of expansive kinship ties, and possibly cooperation, at least 100,000 years ago. Psychological and behavioral experiments suggest we have an evolved cognitive specialization for reasoning about social exchange and for social learning.

POOR, NASTY, BRUTISH AND SHORT?

The word 'poor' in Hobbes's description corresponds to some aspects of reality in small-scale societies. However, relative egalitarianism in material resource access limits the formation of rigid, pronounced gradients in health and longevity along status lines. This diminishes subjective experience of deprivation and subordination and associated health impacts, including chronic psychosocial stress and depression.



Small-scale societies often face harsh and unpredictable environments, predation, and infectious diseases. Nevertheless. Hobbes's characterization overlooks numerous leisure activities and rituals that play central roles in information exchange, entertainment, and group cohesion.

Hobbes's use of the word 'brutish' ignores the many subtle mechanisms deployed to manage conflict and anti-social behavior. Potential tyrants cannot easily dominate, facing countervailing pressure from coalitions of others. Sanctioned violence is often reserved only for extreme cases, such as punishing murderers. Moral outrage, criticism, shaming, ridicule, and ostracism are used to keep transgressors in check. 'Lab in the field' experiments suggest that virtuous people are sought out as social partners. Conflict resolution is an important duty for leaders (see Zachary Garfield, page 20). Other tactics for minimizing aggression include dispersal, marriages, trance healing dances, 'fireside chats', or portraying violence as a random and isolated incident.

Small-scale societies also show considerable ingenuity in mobilizing members to participate in hunting and defense. There is, of course, a darker side to such cooperation. As discussed by

Michael Wilson in the previous issue of IAST magazine, warfare is a strategy that probably emerged before agriculture from evolved psychological mechanisms such as xenophobia and parochial altruism.

Hobbes was also wrong to characterize life in the state of nature as 'short'. If they survive to 15 years, the modal age of death for hunter-gatherers, horticulturalists, and even 18th-century Europeans, ranges from 68 to 78 years. Moreover, many modern causes of morbidity and mortality - such as cardiovascular disease. diabetes. obesity, hypertension – are rare or absent in small-scale societies.

WHAT MAKES US HAPPY?

Recent evidence supports the view that most individuals derive important benefits from their social networks. Material circumstances can inflict great unhappiness, but above a certain level of material comfort the contribution of material prosperity to human fulfilment is relatively unimportant.

Psychologists recognize that social identity is an essential component of the self-concept. In experiments among subsistence and market-integrated populations, in-group fusion predicts

costly self-sacrifice. Limited evidence from small-scale societies suggests that inability to provide and share resources reduces psychological wellbeing among aging adults.

 \mathcal{O}

"Darwin was profoundly aware of the intensely social nature of life before agriculture. His belief that natural selection has shaped our behavior is strongly supported by evolutionary social science"

Despite their value in clarifying what can and should be expected of political institutions, the social contract philosophers failed to appreciate the ability of human societies to develop informal solutions. In contrast, Darwin was profoundly aware of the intensely social nature of life before agriculture. His belief that natural selection has shaped our behavior is strongly supported by evolutionary social science. Philosophical ideas about human nature can only be enriched by embracing empirical evidence of the resilience and complexity of smallscale societies.



GLADYS BARRAGAN-JASON. MAXIME CAUCHOIX, ALEXIS CHAINE, AND ASTRID HOPFENSITZ

STRANGER THINGS

How do children cooperate with others?

Adult humans are better at cooperating with family and friends than with strangers. However, little is known about whether this preference varies with age. CNRS SETE-Moulis and IAST researchers Gladys Barragan-Jason, Alexis Chaine, Astrid Hopfensitz and Maxime Cauchoix devised an experiment to investigate what happens when children play a cooperative game. They came up with surprising results.

WHAT INSPIRED THIS RESEARCH?

Gladys Barragan-Jason: We knew that, for several animals, social traits shift with age and we wondered whether that could be the case for humans as well. While cooperation itself has been studied, few articles have looked into the possible changes in cooperation between infancy and adulthood. We thought it worth investigating and set up this experiment.

WHAT WAS THE EXPERIMENT LIKE?

Alexis Chaine: We recruited 290 children from 15 elementary schools in southwestern France and asked them to play a game in which they had to cooperate to reach a reward. Only by pulling on a rope at the same time and at similar speeds would the children each obtain a reward.

GBJ: We explained to the children that they would play together to each win a reward but provided no further instructions, making the game more difficult than in previous similar studies. We let the children try three times before ending the game.

Astrid Hopfensitz: We paired the children in different ways: Sometimes they were siblings or friends from the same school; other times they were complete strangers. We quantified the degree of closeness between friends by asking both their teachers and the children themselves how they perceived their relationship.

WERE CHILDREN GOOD AT COOPERATION?

GBJ: 63% succeeded on their first try, 21% on their second try and 6% on their third try. Only 10% of the pairs failed to reach the reward – so children are very good at cooperating. What surprised us is that this cooperation wasn't homogenous and depended a lot on whether the children were siblings, friends or strangers.

AH: We anticipated that brothers and sisters and friends would be better at cooperating than strangers, as is the case for adults. But our results proved otherwise, hinting at a change in behavior with age.



The researchers found that children are less likely to cooperate with their brothers and sisters than with friends or strangers.

WHAT WAS THE DIFFERENCE BETWEEN SIBLINGS, FRIENDS AND STRANGERS?

AH: We found that children are less likely to cooperate with their brothers and sisters than with friends or strangers. Friends were 71% successful and strangers 68% successful, while siblings were less likely to succeed with a 44% success rate.

AC: Studies in adults show a very consistent pattern of kin preference over non-kin across a broad variety of subjects and populations. We know, for example, that adults from Western industrialized countries trust their siblings more, and are more likely to cooperate with people who look like them. They're also less likely to punish a sibling after rule transgression than a stranger. This difference between children and adults is striking and hints at a shift in behavior. Our results were consistent with age so we believe that the shift happens beyond the age of 10.

WHY DO YOU THINK CHILDREN MAY BE BETTER AT COOPERATING WITH STRANGERS?

AC: Our theory is that cooperative skills serve a different purpose for children than for adults. We think that children try to develop friendships, reinforcing and increasing their social network.

GBI: We found that having a larger social network before the experiment was related to better performance in the game. If cooperation serves to strengthen or build a social network, we would predict that cooperation should alter future interactions. We found that the relationship quality of non-friends improved significantly after performing the rope-pulling task as partners. Overall, our results show that cooperation between non-kin partners plays a key role during childhood. We argue that this serves to expand a child's social network since non-friends had a more positive view of their 'unknown' partner after interacting during the cooperative task.

AH: We think that a possible explanation could also come from the lack of attention between siblings. We measured the number of gazes between pairs during the first trials and it was indeed a strong predictor of success. It seems that brothers and sisters pay less attention to what their sibling is doing than they do when it's a friend or a stranger.

"We found that children are less likely to cooperate with their brothers and sisters than with friends or strangers"

5



ANDAINE SEGUIN-ORLANDO

PREHISTORIC PUZZLES

Decoding DNA from Neolithic farmers

Former IAST paleogeneticist Andaine Seguin-Orlando is shining new light on France's prehistoric past, when the adoption of agriculture set human history on an entirely new course. Using state-of-the-art technology at the recently launched Centre for Anthropobiology and Genomics of Toulouse (CAGT), her research is the first to reveal the genetic makeup of ancient humans who lived in France during the Late Neolithic and the dawn of the Bronze Age.

uring the late Stone Age, descendants of Neolithic farmers from Anatolia supplanted their hunter-gatherer predecessors across Europe. This period also coincides with the arrival in Western Europe of descendants of nomadic herders from the Pontic-Caspian Steppes. While the genetic intricacies of these major population and societal shifts have been examined in other parts of prehistoric Europe, until now they have not been explored in the area we now call France.

9

Leading an interdisciplinary team of experts from prestigious institutions in the US, France and Sweden, Andaine examined DNA from bones and teeth found at French collective burial sites associated with Late Neolithic, Bell Beaker, and Early Bronze Age archaeological contexts. The researchers sequenced and analyzed the complete genomes of 24 people who lived in the Paris Basin and around Narbonne from 3,700 to 5,400 years ago.

Their results confirm that the major genetic transition which took place during this time period in other parts of Europe also occurred in France. Her study has also uncovered surprising evidence that genetic traces of hunter-gatherer populations existed in northern France during a time for which there is no material evidence of this group's culture on the archaeological record.

HUNTER-GATHERER ORIGINS

Winner of the 2019 L'Oréal-UNESCO For Women in Science young talent award. Andaine says it now appears that the Neolithic communities living more than 5,000 years ago around Mont-Aimé (northern France) comprised a genetic mosaic, and included individuals with dark skin, hair, and eyes. For the most part, their genomic makeup was similar to that found in individuals from Ireland and Germany during

the same time period. The majority of genomic material in these individuals was inherited from Anatolian ancestors with a small fraction derived from the Mesolithic hunter-gatherer population who previously occupied the territory of presentday France.

However, in some of the individuals from this time period - in particular, a father and his daughter buried in these graves the majority of their genome was found to be of hunter-gatherer origin. This evidence indicates that hunter-gatherer populations were still interbreeding with Anatolian descendants up to 5.800 years ago. To explain the persistence of this culturally invisible population, Andaine suggests that local hunter-gatherers ultimately adopted the lifestyle of Neolithic

communities. This process of acculturation seems to have accompanied the gradual disappearance of hunter-gatherer cultures in France and beyond.

NOMADIC ANCESTORS

Another major discovery in Andaine's study was that some individuals from this time period carried another genetic component characteristic of nomadic herders from the Western Steppes. This genetic material was found in individuals living

near Narbonne (southern France) around 4.400 years ago, as a result of interbreeding that took place three centuries earlier. Evidence of similar

"During the late Stone Age, descendants of Neolithic farmers from Anatolia supplanted their huntergatherer predecessors across Europe. This period also coincides with the arrival of nomadic herders from the Pontic-Caspian

Steppes"

The Late Neolithic to Bronze Age transition was marked by major genetic changes in Europeans but is poorly documented at the genomic level in France, where most focus has been on the Middle Neolithic. With new extensive wholegenome time series for this period, Andaine and her fellow experts in field archeology, physical anthropology and archeogenetics have extended the timeframe during which Steppe-related and hunter-gatherer ancestries entered and vanished in this region. The genetic diversity uncovered by this research demonstrates the complexity of interactions, even within local communities, that accompanied the dawn of farming societies in western Europe.

0.22 0.24 0.26 0.28 0.3 0.32 0.34 0.36 0.38 0.4 0.5 0.6 0.7

Andaine and her coauthors analyzed samples from all around Europe

interactions with Steppe pastoralists only a few centuries later has also been found in Iberia and the British Isles.

Paris Basin Neolithic and Mesolithic groups interbred as recently as 5.800 vears ago

Steppe herders interbred with populations in southern France as early as 4,700 years ago

30 petrosal bones, **5** post-cranial bones. and 18 teeth from prehistoric graves were prepared for DNA sequencing

FIND OUT MORE

To read 'Heterogeneous Hunter-Gatherer and **Steppe-Related Ancestries** in Late Neolithic and Bell Beaker Genomes from **Present-Dav France** (Current Biology, 2021) and other research by Andaine, see cagt.cnrs.fr/seguin-orlandoandaine





INGELA ALGER, JONATHAN STIEGLITZ

DADS VS CADS

Did caring fathers evolve due to climate change?

Paternal care is rare among mammals and absent among our closest great ape relatives. So why do human fathers provide for their children? With their co-authors, IAST's Ingela Alger and Jonathan Stieglitz use evolutionary game theory to show that doting dads emerged when ecological change increased the incentives for males to cooperate with others, and to invest in their children's development.

WHY DOES HUMAN FATHERHOOD POSE A PUZZLE FOR EVOLUTIONARY SCIENTISTS?

Paternal care is widespread in modern hunter-gatherer societies, with males helping in various ways, but particularly to feed children for up to two decades. The evolution of such prolonged paternal care seems remarkable. A would-be "dad", who provides food for his mate and children, risks being outcompeted in terms of biological fitness by a "cad", who focuses only on promiscuous mating instead of investing in offspring. If cads abound, their competitive advantage creates a formidable barrier for the emergence of dads.

It has been suggested that this barrier was overcome when ancestral females started mating preferentially with males who provided them with food. Yet behavioral observations of chimpanzees, which provide indirect insights into ancestral hominin sociality, are not consistent with this explanation. Despite reports of chimpanzees exchanging of meat for sex. prevailing evidence points to rank and aggression as key determinants of male reproductive success. Even if buying sexual access with food is an incipient reproductive strategy, there is still the "cad vs dad" tradeoff to overcome. This scenario also requires simultaneous evolutionary changes in both sexes

HOW DID PREHISTORIC CLIMATE CHANGE IMPACT THE BALANCE OF POWER?

Around 5-8 million years ago, the African savanna began to dry out, increasing the value of nutritious, diverse, dispersed, and hard-to-obtain plant and animal foods. Ancestral hominins adapted to this in various ways, embracing bipedal locomotion, dietary flexibility, and tools to thrive in diverse environments. Climateinduced changes in

profitability the of different ecological strategies likely selected for increased brain size. greater time devoted to learning and cultural innovation, and lengthening of the juvenile period.

In these conditions. cooperation significantly increased per-capita benefits. Synergies, or "complementarities".

between males and females resulted from specialization in hunting, foraging and childcare. Protein and fat acquired by males paired well with carbohydrates acquired by females. Complementarities also arose between males due to higher returns from hunting in groups, and from sharing food to lower starvation risk. These ecological and cooperative strategies favored the evolution of caring fathers, as the impact of food provision on their children's survival substantially increased.

HOW DO YOU TEST THE IMPACT OF ECOLOGICAL CHANGE?

We use evolutionary game theory to show how cooperation between women and men, and among men, can select for male

provisioning. We identify a tipping point where gains from provisioning overcome costs from paternity uncertainty and the dad strategy becomes viable.

Our model reconstructs the behavior of two male types: "cads," who do not provision offspring and mate with multiple females; and "dads," who provision offspring and mate with only one female. In a population predominated by cads, a dad paired with a cad would have lower

"When ecological change

increases the benefits of

cooperation, our model

reveals that 'dads' can gain

a fitness advantage over

'cads'. If sons inherit their

biological father's traits,

then over time dads will

reproductive But when ecological change increases the benefits of cooperation. our model reveals that dads can gain a fitness advantage over cads. If sons inherit their biological father's traits, then over time dads will increase in number.

increase in number" Our simulations suggest that, with sufficient complementarities. dads can emerge even in the face of high paternity uncertainty. Female sexual infidelity, it seems, is not an insurmountable obstacle to the evolution of paternal care, in contrast to some traditional evolutionary explanations of human pair bonding. Stable polymorphic states are also possible, meaning that dads need not necessarily eliminate cads.

WHAT ARE THE AVENUES FOR **FUTURE RESEARCH?**

Our research focuses attention on critical missing pieces of paleo-climatic, archaeological, and genomic evidence about the emergence of paternal care. Increasingly sophisticated methods, such as radioisotope analysis, can provide information about diets of ancestral

In foraging societies...

Men provide, on average, 66% of calories

and 92% of couples are monogamous

success.

hominins. Since hunting requires high levels of strength and skill, and is regularly performed by men cross-culturally. evidence of animal products in the diet of juveniles could suggest provisioning. perhaps by ancestral dads. There is also growing evidence of joint neural, hormonal, and behavioral responses underlying the transition to fatherhood in modern humans, including lower testosterone production and sexual drive, higher oxytocin production to facilitate bonding, and increased activation in brain regions important for face emotion processing. Paleogenomic data may shed light on the timing and nature of these changes.

Our approach could be extended in several directions. We might investigate, for example, complementarities in tool production and domestic tasks. We could model the active selection of mates by females, or the fitness benefits of female infidelity. Would our results change if males interacted in larger groups? How would the presence of grandparents affect tradeoffs? The model may also be applicable to modern trends, such as the matrifocal family with limited paternal investment.

FIND OUT MORE

0

Ingela and Jonathan's paper 'Paternal Provisioning Results from Ecological Change' is published in PNAS > www.iast.fr



21
ZACHARY GARFIELD
CHIEFS, SHAMANS
AND FOLLOWERS
Take me
to vour
loador
ICAUCI
Leaders and followers are critical to understanding human
psychology, social organization, and culture. Teaming up with researchers at Washington State University, IAST evolutionary
anthropologist Zachary Garfield has conducted the first
systematic investigation of the functions, qualities, costs and benefits of leader-follower dynamics, using a diverse sample of
non-industrial societies

hat makes a leader stand out from the pack? How much does leadership vary between cultures and in different social contexts? What are the benefits and costs for group members? Zachary and his coauthors sought answers to these questions in a database of 1,212 ethnographic texts from 59 different cultures. Their exploratory study coded entirely new variables on the functions and qualities of leaders and the costs and benefits of leadership and followership, providing a unique cross-cultural assessment of 109 leadership traits.

WHO'S THE BOSS?

Crunching the numbers, Zachary's results suggest that certain leadership qualities are widespread, or even universal. "Leaders are seen as high status, knowledgeable or intelligent, and experienced or accomplished in about 80% or more of cultures, and function to resolve conflicts, organize cooperation, and provide counsel or direction in over 70% of cultures. Leaders benefited materially, reproductively, or socially in 50% or more of cultures."

Leadership dimension	Туре	% of cultu
Knowledgeable/intelligent	Qualities	81.4
Resolve conflict	Functions	78.0
Misc. social functions	Functions	72.9
Material resources	Leader Benefits	69.5
Increased social status	Leader Benefits	66.1
Wealthy	Qualities	66.1
Group representative	Functions	64.4
Strategic nepotism	Qualities	64.4
Generosity	Qualities	61.0

Both gains and losses in terms of social status and material resources were widely reported, suggesting that leadership can be a high-risk, high-return strategy. Nevertheless, there was more evidence of benefits than costs for both leaders and followers.

The researchers also found important variation in leadership traits depending on: group context (for example, leaders of kin groups tended to be older and to provide counsel and direction); subsistence strategy (for example, hunter-gatherers tended to lack leaders with coercive authority); sex (for example, female leaders were associated with family contexts); and continental region.

Evidence for several theoretically important leadership traits was surprisingly rare. Movement or migration was identified as a leader function in only 13.6% of cultures, of which the vast majority were hunter-gatherers. Machiavelli may have raised an eyebrow if he had been told that less than a third of cultures appear to regard leaders with fear, or as a source of moral authority or "fairness". Many observers of industrialized societies have focused on leaders' sex appeal, but only 3.4% of Zachary's largely non-industrial sample provided evidence that leaders were physically attractive.

SUPERNATURAL POWERS

Zachary's results provide broad cross-cultural support for influential evolutionary theories that

stress the significance of leader aggression and coercion (dominance), as well as culturally acquired skills (prestige). However, shamans emerged as a major leadership category that refutes the idea that followers receive either the benefits of 'brains' or the costs of 'brawn'. "Shamanism appears to be a distinct form of leadership that combines a strategy of inducing fear, similar to the dominance strategy, but is based on knowledge and expertise, similar to the prestige strategy... The dominance-prestige and 'dual-model' theories of leadership cannot easily account for shaman leaders nor 'chiefs-for-a-day' (managers). These models have conflated the ability to provide 'benefits' with knowledge and expertise, and the ability to impose 'costs' with physical formidability. As shaman leaders demonstrate, knowledge and expertise can both provide benefits and impose costs, and the same goes for physical formidability."

"Theories of leadership have conflated 'benefits' with knowledge and expertise, and 'costs' with physical formidability. As shaman leaders demonstrate, knowledge and expertise can both provide benefits and impose costs, and the same goes for physical formidability"

 physical lity"
 This diversity remains a huge challenge for any theory that seeks to capture the reality of human leadership. Yet Zachary's findings suggest promising avenues for the expansion and synthesis of existing perspectives. "Leaders across cultures," his paper concludes, "rely on a range of individual competencies, including cognitive, supernatural, material, social, and physical endowments, to organize group members, implement strategic actions, provide prosocial services to the group, and impose costs, all while conforming to cultural norms."

Leaders are seen as high status, knowledgeable or intelligent, and experienced or accomplished in over 80% of cultures. Leaders resolve conflicts, organize cooperation, and provide counsel or direction in over 70% of cultures. Leaders benefit materially, reproductively, or socially in over 50% of cultures

FIND OUT MORE

Universal and variable leadership dimensions across human societies' *(Evolution and Human Behavior,* 2020) and other articles by Zachary > www.iast.fr

See also research by IAST's Manvir Singh on shamanism and religious leaders at > www.manvir.org

3

The importance of shamans highlights the value of evidence from non-industrial cultures. Outside of anthropology, most scholarship on leadership is based on data from rich, Western societies. Zachary's results underline that this problem cannot be remedied by a simple, 'non-Western' solution. "Our research clearly demonstrates enormous diversity among populations that are now often categorized as 'non-WEIRD', 'traditional', or 'small-scale'. Anthropologists have often made the opposite mistake in essentializing diverse 'others' and failing to recognize deep similarities among peoples of all cultures."

es

22



BORIS VAN LEEUWEN

SEX HORMONES AND PREFERENCES

Can personality be predicted at birth?

How far has our personality developed when we are born? New research by economist Boris van Leeuwen (Tilburg University), as part of an international team including former IAST colleagues Jeanne Bovet and Jonathan Stieglitz, uses umbilical-cord blood data to investigate the possibility of a link between neonatal sex hormones and later-life preferences. Partly funded by the 2016 IAST Multidisciplinary Prize, their analysis challenges previous findings that rely on finger-length ratios and smaller sample sizes.

WHAT DO WE KNOW ABOUT THE EARLY DEVELOPMENT OF OUR PERSONALITY AND PREFERENCES?

Social scientists have long been fascinated by such questions. Why do some people take risks? What makes some of us more prosocial? Recent studies in economics provide causal evidence t h a t preferences are shaped by environmental factors in childhood. This process may even begin before birth: in the health and psychological sciences, there is now significant evidence that the fetal environment has lifelong influences on health, behavior and cognition, as well as important socio-economic outcomes. Exposure in utero to sex hormones such as testosterone is thought to have long-lasting organizational effects on the brain. Differences in this exposure may help explain differences in personality and preferences both between and among men and women.

Preferences are the building blocks of economic models and relate to many decisions in daily life. Risk preferences influence health behavior, leisure activities and financial decisions. Competitiveness is associated with study choices and career paths. Social preferences predict whether people make sacrifices to contribute to social welfare. A large literature links proxies for prenatal sex hormones with economic preferences but the relationship is not well understood.

WHAT IS THE ADVANTAGE OF USING UMBILICAL-CORD BLOOD TO MEASURE SEX HORMONES?

Most previous studies use the ratio of the length of an adult's second and fourth digits (2D : 4D) as a proxy for sex hormone exposure during pregnancy. Numerous studies have linked 2D : 4D to outcomes including aggression. sexual orientation. sports performance, risk taking, and prosocial behavior. Yet the validity of this proxy has been questioned. Some correlations have been found between

testosterone levels in amniotic fluid and 2D : 4D, but sample sizes in these studies are small and results are inconsistent. Digit ratios change after birth, and studies among huntergatherers in Tanzania suggest that 2D : 4D sex differences are not universal.

An ideal study design would use direct measures of fetal sex hormones. But sampling human fetal tissue or experimentally manipulating fetal hormones is not feasible for obvious ethical reasons. Instead, we used umbilical-cord blood which is thought to reflect hormone exposure during late gestation, a period which non-human animal models suggest is critical for neurodevelopment. We took advantage of cord-blood data collected at birth during the ongoing Raine Study in Australia, for which 2,900 pregnant women volunteered between 1989 and 1991. When the women's offspring reached 25-27 years old, we conducted incentivized experiments to measure their preferences related to risk tolerance, competitiveness, patience, reciprocity, trust, and honesty.

WHAT ARE YOUR STUDY'S KEY FINDINGS?

Our main objective was to link direct measures of sex hormones at birth to later-life economic preferences. We replicate typically observed sex differences, finding that men are more risk tolerant, competitive, patient and negatively reciprocal. However, we find no significant associations between testosterone at birth and preferences, except for competitiveness. This effect runs opposite to the expected direction: higher testosterone at birth is associated with lower competitiveness.

We also wanted to test the robustness of earlier findings regarding the relationship between 2D : 4D and economic preferences, but with a larger sample size than most previous studies. Here, too, we find no significant associations. Our results suggest a reinterpretation of prior findings relating 2D : 4D to economic preferences, and highlight the need for large-sample studies.

"Our study replicates typically observed sex differences. However, we find no significant associations between testosterone at birth and preferences, except for competitiveness. This

Future research will hopefully improve the validation of measures of sex hormone exposure in utero. All the current measures have their limitations, and there are relatively effect runs opposite to the few validation studies for these expected direction" measures. Given that more than 1400 studies rely on 2D : 4D to assess fetal hormonal exposure, it is essential to better understand this measure's validity. Given that the effects of prenatal hormone exposure are likely to be small, we believe that studies with larger samples are crucial to make more definitive claims.

> Our work develops understanding of a research area that is rich in possibilities, and one that we hope will shed more light on the early life development of preferences.

WHAT ARE THE IMPLICATIONS FOR FUTURE **RESEARCH?**

FIND OUT MORE

'Do sex hormones at birth predict later-life economic preferences? Evidence from a pregnancy birth cohort study' by Boris Van Leeuwen, Paul Smeets, Jeanne Bovet, Gideon Nave, Jonathan Stieglitz and Andrew Whitehouse

> www.iast.fr

23





JOIN OUR RESEARCH CENTER IN THE HISTORIC CITY CENTER OF TOULOUSE, SOUTHWEST FRANCE

We're offering Research and Visiting Fellowships in a large range of disciplines in the social, behavioral and life sciences: anthropology, evolutionary biology, economics, genetics, history, law, mathematics, neuroscience, philosophy, political science, psychology and sociology.



